Figure 1. *Luidia superba* A. H. Clark being collected at 18 m on sand bottom, Tagus Cove, Isabela, Galapagos Islands.

to be an efficient predator. Luidias are generally voracious, and Eichelbaum (1910), reporting on the stomach contents of *L. sarsi*, counted 53 ophiuroids, one heart urchin, and numerous fragments of asteroids and ophiuroids from the stomach of one specimen. Specimens of *L. clathrata* in the National Museum of Natural History with a major radius (R) of only 140 mm contain whole tests of the sand-dollar, *Mellita quinquesperforata*, with a diameter of 50 mm. It was therefore somewhat disappointing to find the stomachs of two of the Galapagos specimens completely empty, and only a few spines from an irregular echinoid in the stomach of the third specimen. However, there is no doubt that they are efficient predators. The infauna at Tagus Cove is extremely rich in both numbers and diversity. High nutrient level cool water reaches the surface here via upwelling of the Equatorial Undercurrent (Pak and Zaneveld, 1972). This "optimum" environment probably accounts for the unusually large size of *Luidia superba* here. This gigantism is also reflected in other components of the biota, e.g., another seastar, *Pauliella horrida galapagensis*, and a sea pen both reach sizes well above average (pers. obs.).

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MYXOBOLUS LATIPINNACOLA NEW SPECIES (MYXOSPORIDA) FROM THE SAILFIN MOLLY, *POECILIA LATIPINNA* (LESUEUR) IN SOUTH FLORIDA

Diana Wold and E. S. Iversen

Abstract—We describe a new species of myxosporidan, *Myxobolus latipinnacola*, infecting the gallbladder of the sailfin molly, *Poecilia latipinna* (Lesueur). The polysporous cysts located in the wall of the gallbladder are nearly spherical, about 59 μm in diameter. Spores are ellipsoidal in front

view, and approximately lenticular in side view. Fresh solitary spores in bile measure 13.1 μm in length, 8.6 μm in width and 6.7 μm in thickness, with polar filaments 17.3 μm.

The Poeciliidae family of fishes occur in tropical and temperate waters over a broad range of fresh to saline habitats (Rosen and Bailey, 1963). These small live-bearers average less than 100 mm in total length. One of the poeciliids, the sailfin molly, *Poecilia latipinna* (Lesueur), was examined for protozoan parasites. The species ranges from North Carolina through Florida and along the coast of the Gulf of Mexico to the Yucatan Peninsula of Mexico. Sailfin mollies are generally small, less than 75 mm in length. Their diet consists mainly of plant debris, periphyton, ostracods, rotifers, and mosquito larvae (Odum, 1970). They play an important role in mosquito control by consuming large numbers of the larvae. The molly is in turn eaten by wading birds, especially the herons.

Myxosporidan cysts were found in the wall of the gallbladder and free spores were present in the bile of the molly. These spores belong to the genus *Myxobolus*, having two anterior polar capsules, ovoidal or ellipsoidal flattened valves without posterior processes but possessing an iodinophilous vacuole in the sporoplasm (Kudo, 1920). Due to the variability in the occurrence of the vacuole in other *Myxobolus* and *Myxosoma* spores, there has been controversy over the value of this character to separate the two genera. The question is still unsettled. On the basis of the variability Walliker (1968) found in the occurrence of the iodinophilous vacuole and its glycogen content, she concluded that *Myxosoma* and *Myxobolus* should be synonymized. Galinsky and Meglitsch (1969) assert that the vacuole is a useful and well-established taxonomic character, although its presence is sometimes difficult to demonstrate. Podlipaivi (1974, English Summary) states that the vacuole functions in nutrient storage, therefore is ". . . a real morphological formation in spores of Myxobolidae and should be used in systematics."

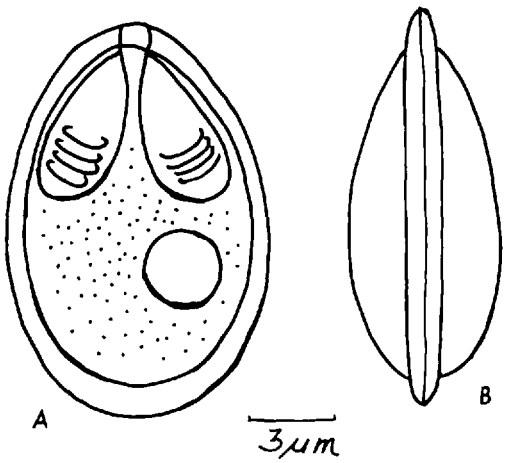

Figure 1. *Myxobolus latipinnacola* new species front view (A) and side view (B).

The vacuole in the spore described in this paper was constant in size and has been observed in all stained spores. Therefore, we have assigned the myxosporidan we found to the genus *Myxobolus* and describe it as new. The parasite differs sufficiently from other similar species of *Myxobolus* and *Myxosoma* reported in the literature to consider it a new species.

Methods

Twenty-two sailfin mollies 35 to 76 mm total length were examined from the brackish water of the mosquito control canals on Virginia Key (Miami), Florida from March 1976 to March 1977; all specimens were infected with the myxosporidan. Measurements of the parasites were taken from live material and recorded in micrometers (μm). Averages are followed by the ranges in parentheses. Freshly prepared Lugol's iodine and Best's carmine red stains were used to test the presence of an iodinophilous vacuole. The most favorable results were obtained with Lugol's solution, which stained the vacuole a deep orange. For

scanning microscopy (SEM) spores were washed in 10% seawater and fixed in 4% glutaraldehyde, then washed in seawater again. The next three washes consisted of 3:1, 1:1, 1:3, salt to fresh water. The fourth wash was 100% fresh water. The next three washes were in the ratio of 3:1, 1:1, 1:3 fresh water to ethanol. This was followed by two washings of 100% ethanol. The last two washings consisted of 1:1 ethanol to xylene and 100% xylene. The spores were then air dried. All solutions were filtered through a nuclipore filter (pore size 0.4 μm) on which the spores rested. Each of the steps took five minutes.

Measurements of spores preserved in 10% formalin were made to determine the amount of shrinkage and distortion caused by formalin.

Myxobolus latipinnacola new species

Figures 1–3

Description.—SPORE. Front view, ellipsoidal, length (N = 19) 13.1 μm (12.0–14.0), width (N = 19) 8.6 μm (7.1–9.8). Side view, slightly flattened, ellipsoidal to lenticular, thickness (N = 4) 6.7 μm (5.7–7.3). The valves are symmetrical with a sutural ridge slightly thicker at the ends (1.6 μm) than in the middle (1.2 μm) in front view (Fig. 1). A straight line can be followed all around the spore and bisecting the sutural ridge. The two polar capsules are pyriform to ellipsoidal and measure (N = 33) 5.1 μm (3.9–5.9) by 2.2 μm (1.7–2.8). Both polar capsules open at the anterior end of the spore case. The distance between the two openings is approximately 1 μm. No intracapsular appendix was noted. The polar filament is wound about four times in the polar capsule. When extruded, it measures (N = 4) 17.3 μm (15.2–21.4) in length and about 0.5 μm in width. The plane of the coiled polar filament varies slightly from perpendicular to an acute angle to the central axis of the spore. The diameter of the iodinophilous vacuole is (N = 6) 2.9 μm (2.7–3.2).

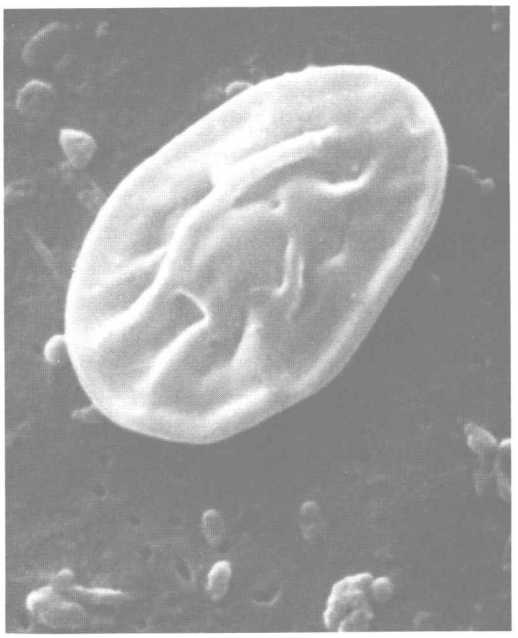

Figure 2. Scanning electronmicrograph showing typical grooves and ridges in the spore case (× 10,000).

A uniform pattern of ridges and grooves was evident in the spore envelope from several different spores as seen in scanning electronmicrographs (Fig. 2).

CYST. Spherical surrounded by a thick layer of tissue and imbedded in the gallbladder wall (Fig. 3), diameter (N = 7) 59 μm (49–66). The number of spores per

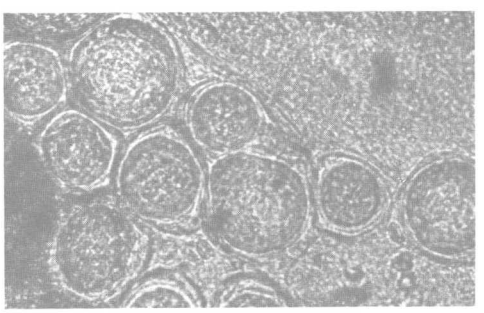

Figure 3. Cysts of *Myxobolus latipinnacola* new species in the gallbladder wall of *Poecilia latipinna* (× 340).

Table 1. Comparison of *Myxobolus latipinnacola* new species with other species of *Myxobolus* and *Myxosoma*

Parasite Host Location and Source	Location in host; state of material	Spore length, width, thickness (μm)	Polar capsule length, width (μm)	Polar filament length (μm)	No. filament windings
Myxobolus latipinnacola n. sp. *Poecilia latipinna* Virginia Key, Miami, Florida	Gallbladder Fresh	13.1 × 8.6 × 6.7	5.1 × 2.2	17.3	4
	10% formalin	11.8 × 8.5 × ----	4.6 × ----	----	----
Myxobolus lintoni *Cyprinodon variegatus* Woods Hole, Mass. Gurley, 1894	Superficial musculature subcutaneous tissue; state of material not given	13.9 × 11 × 8	----	Ca. 20	----
Myxobolus funduli *Fundulus heteroclitus* *F. majalis* Woods Hole, Mass. Hahn, 1917	Branchiae and musculature; state of material not given	14.3 × 6.7 × 6.7	6.5 × 2	42 – 57	12 – 14
Myxosoma funduli *Fundulus heteroclitus* *F. majalis* Woods Hole, Mass. Kudo, 1920	Branchiae; state of material not given	14 × 8 × 6	8 × 2	38 – 42	Ca. 12
Myxosoma hudsonis *Fundulus heteroclitus* New York, N. Y. Bond, 1938	On scales; 4% formalin	12 × 7 × ----	4.5 × 2.3	----	Ca. 6–8

cyst varied from six to over 50. Also, the number of cysts per gallbladder varied from three to 20.

TYPE HOST. *Poecilia latipinna* (Lesueur), Virginia Key, Florida. Syntype material deposited in the USNM. Helm. collection No. 74638.

Relationships.—Of the many species of *Myxobolus*, two are similar to *Myxobolus latipinnacola* n. sp. in one or more characters. These two are *Myxobolus lintoni* and *Myxobolus funduli*. Two species from the genus *Myxosoma* are also similar in spore characters: *Myxosoma funduli* and *Myxosoma hudsonis* (Table 1).

Myxobolus funduli and *Myxosoma funduli* which have been described from cyprinodont and poeciliid fishes have spores of approximately the same size as *M. latipinnacola* n. sp., but differ in length, thickness and several other respects. The spores of *Myxobolus funduli* and *Myxosoma funduli* have longer polar capsules; the polar filament has three times as many windings, and they are both located in a different part (branchiae) of the host than *M. latipinnacola* n. sp. *Myxobolus lintoni* has spores

slightly larger than *M. latipinnacola* n. sp. and infects the muscle rather than the gall-bladder. The polar capsules of *M. lintoni* converge at the anterior end of the spore. *Myxosoma hudsonis*, found encysted on scales, has spore measurements smaller than the fresh spores of *M. latipinnacola* n. sp. but similar to the preserved spores. *Myxosoma hudsonis* differs from *M. latipinnacola* n. sp. in that the polar filament has three to four more windings and the polar capsules open to one side of the spore rather than on the anterior end.

Myxobolus lutzi has been described from the testes of *Poecilia vivipara* in Brazil (Walliker, 1969). Despite the occurrence of this parasite in the same genus of host as *Myxobolus latipinnacola* n. sp., we have not entered it in Table 1 because of the considerable differences in spore sizes between the two species.

These differences in spore sizes, differences in hosts, geographic location of hosts, and location in the hosts lead us to conclude that the myxosporidan parasite we found (*Myxobolus latipinnacola*) in *Poecilia latipinna* is new to science.

Remarks.—In addition to the myxosporidan we describe other parasites have been reported from the sailfin molly by Bangham (1941), Hutton (1964), Hutton and Sogandares-Bernal (1960) and Lumsden (1963 a and b).

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